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ABSTRACT

Early career experiences of a sample of 233 University of Washington doctorates were studied. Doctorates were initially grouped into seven degree areas (physical science, biological science, social science, humanities, education, engineering, and other). As hypothesized, significant differences were found between the genders in their distribution across the degree fields. However, after statistically controlling for the interaction of gender and degree field, the latter rather than the former was the variable that most often differentiated this group of doctorates. That is, the degree fields differed significantly on research orientation, satisfaction with their doctoral program, likelihood of re-entering the same program today, proportion with a master's degree, amount of professional work experience prior to obtaining their doctorate, and professional identification as assessed by number of memberships in professional organizations. Only for one survey item did male and female doctorates differ significantly regardless of degree field: females were more likely to have experienced difficulty in obtaining a doctoral-level position in their area after receiving their doctorate. The genders within a degree area, however, did not differ significantly in type of position eventually held. References are included. (SW)

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Early Career Experiences of UW Doctorates as a Function of Degree Field and Gender

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Abstract

A sample of 233 University of Washington (UW) doctorates completed a survey which focused on their early career experiences. Doctorates were initially grouped into seven degree areas (physical science, biological science, social science, humanities, education, engineering, and other). As hypothesized, significant differences were found between the genders in their distribution across the degree fields. However, after statistically controlling for the interaction of gender and degree field, the latter rather than the former was the variable which most often differentiated this group of doctorates. That is, the degree fields differed significantly on research orientation, satisfaction with their doctoral program, likelihood of re-entering the same program today, proportion with a master's degree, amount of professional work experience had prior to obtaining their doctorate, and professional identification as assessed by number of memberships in professional organizations. Only for one survey item did male and female doctorates differ significantly regardless of degree field: Females were more likely to have experienced difficulty in obtaining a doctoral-level position in their area after receiving their doctorate. The genders within a degree area, however, did not differ significantly in type of position eventually held.

Educational Assessment Center Project #583

Early Career Experiences of UW Doctorates as a Function of Degree Field and Gender

In recent years there has been a growing concern expressed among educators and students alike about the availability of suitable employment prospects for doctoral recipients, especially for those who aspire to collegiate teaching positions (e.g., Trivett, Note 1). In short, there are too few academic jobs avilable for new PhDs who desire faculty appointments. Consequently, professional organizations, such as the National Academy of Sciences, have commissioned studies which explore "alternative" (that is, non-academic) job opportunities for doctorates (see, New work roles sought for PhDs, 1977). Little information, however, is known on a local level about the employment experiences of University of Washington (UW) advanced degree recipients. Therefore, in order to better understand the employment situation with respect to UW doctorates, particularly in their early post-doctoral years, a survey was undertaken which specifically focussed on the three-year period after reception of the doctorate. Do employment patterns of male and female doctorates differ regardless of degree field? Or are the differences most noticeable among the degree fields regardless of gender? The current report, concerning a survey of UW doctorates who were awarded their PhDs in the mid-1970's, is a start on profiling our doctorates on such questions as these. However, before detailing the results of the survey, several hypotheses can be proffered.

It is hypothesized that area of specialization would be related to three important variables. First, men and women would differ in degree field with women more likely to have received doctorates in the biological sciences, education, and the social sciences such as psychology (Astin, 1969; McCarthy & Wolfle, 1975; Solomon, 1973). Next degree field would be related to scholarly productivity with those in the biological and physical sciences having the highest publication rate (Astin, 1969, Note 2; Simon, Clark, & Galway, 1975). And, lastly, it was hypothesized that degree area would be related to reception of post-doctoral fellowship with the physical sciences and biological sciences having had the highest proportion of postdocs (Astin, 1969).

In addition to differences among the various fields of specialization, several hypotheses concerning gender were also garrered from the research literature. As noted above, men and women would differ in their degree area. However, it was hypothesized that within a degree field the genders would not differ on scholarly productivity nor on their degree of "professional identification" as assessed by number of memberships in professional organizations (Simon et al., 1975). Second it was hypothesized that male and female doctorates would differ on their "research orientation" (Ladd & Lipsett, 1976): One would expect male doctorates to more often indicate that they had entered graduate school to pursue a research career, to more likely have been employed as a research assistant while in graduate school, and to more frequently have been employed in a research capacity after having received their degree than female doctorates. Also of interest was the incidence of male-female differences in job placement since evidence of a discrepancy seems to exist in the research literature. That is, some researchers have reported that discrimination in first job placement of doctorates has disappeared (Cartter & Ruther, Note 3), while others have reported a difference in employment rates with women more likely to be unemployed than men (for example, Vetter [1979] has documented this finding among doctoral scientists and engineers). Therefore, of great interest in the current survey would be to see if there were male-female differences on their difficulty in obtaining a doctoral-level position and/or in the actual job placement.

Method

Sample. For the five quarter period from autumn 1974 to autumn 1975, inclusive, 385 doctoral recipients who resided in the United States were surveyed. This sample represents 80% of the total number of doctorates awarded from the University during those five quarters. The response rate to the survey was high. After two mailings 12% (N = 47) were returned unanswered because of undeliverable mailing addresses. Of the remainder (N = 338) nearly three-quarters completed the survey (N = 233).

From among the total group of 338 with useable addresses, did those who completed the survey differ from those who did not? In order to answer this question, doctorates were first categorized by degree field: Physical

sciences, biological sciences, social sciences, humanities, education, engineering, and other. Appendix A lists the specific majors included in each degree area. Table 1 presents the breakdown of survey returns by degree field. Those who returned the questionnaire did not differ significantly from those who did not ($\chi^2 = 3.41$, $df = 6$) with the bulk of doctorates equally divided among four degree areas of physical science, biological science, social science, and humanities.

Table 1

Questionnaire Return Rate by Degree Area

Returned Survey?	PS N(%)	BS N(%)	SS N(%)	H N(%)	ED N(%)	ENGR N(%)	OTHER N(%)	TOTAL N(%)
Yes	40(17)	40(17)	57(24)	40(17)	22(9)	23(10	11(5)	233(100)
No	17(16)	19(18)	18(17)	24(23)	9(9)	12(11)	6(6)	105(100)
Total N	57(17)	59(17)	75(22)	64(19)	31(9)	35(10)	17(5)	338(100)

Note. Abbreviations for degree fields are: Physical Science = PS, biological science, = BS, social science = SS, humanities = H, education = ED, engineering = ENGR, other = OTHER.

Questionnaire. The "Survey of University of Washington Doctorates" (Educational Assessment Center, Note 4) was comprised of two item sets. The first group of seven items related to graduate school: Reason for initially enrolling in graduate school, degree of satisfaction with doctoral program, likelihood of re-entering same program if enrolling in graduate school today, number of years of professional work experience prior to receiving the doctorate, number of articles published prior to completion of doctorate, and number of papers presented at professional meetings prior to receipt of the doctoral degree. The remaining survey items pertained to employment and professional experiences during the three-year period following receipt of the PhD: "job availability status" at time the degree was awarded (ex., returned to job held prior to obtaining doctorate, had position in hand before completing dissertation), difficulty in obtaining

doctoral-level position, first job held after doctorate, satisfaction with job held at time of survey, anticipation of job change in the near future, type of assistance received from UW in job search, number of publications since doctorate, number of papers read since receiving PhD, and number of professional memberships. Background data (such as gender and degree history) were also collected.

Analyses. The analyses considered gender and degree field simultaneously as the independent variables of interest. The specific statistical technique employed for an analysis depended on the scaling of the dependent or response variable. If the dependent variable was continuous, then the general linear model expressed in terms of multiple regression notation was employed and the independent variable (gender and major field) were coded as dummy variables; (Kerlinger & Pedhazur, 1973; Ward & Jennings, 1973). However, if the response or dependent variable was categorical, a log-linear model (Bishop, Fienberg, & Holland, 1978; Fienberg, 1977) was employed to analyze a three-way contingency table (e.g., gender by major by item response) using the ECTA computer program (Goodman, 1973). For log-linear models having no observations in one or more cells because of sampling variability, the constant value of .5 was added to each cell to enable the iterative process in ECTA to converge. When the response variable in a log-linear model was a dichotomous categorical variable then a special log-linear model, termed logit analysis, was appropriate and analyses done via the GLIM computer program (Baker & Nelder, 1978).

Results

As was hypothesized, male and female doctorates differed significantly with respect to degree area as Table 2 reports ($\chi^2 = 24.36$, $df = 6$). A larger proportion than expected of women had degrees in the biological sciences and humanities and a lesser than expected proportion in the physical sciences and engineering. In fact, among the total group of respondents there was not one woman doctoral engineer among the sample. The largest proportion of women had degrees in the humanities (31%) with a slightly lesser proportion in the social sciences (26%). For the male doctorates the largest percentage had received their degrees in social science areas (24%) with almost an equal proportion having been awarded degrees in the physical sciences (21%).

Table 2

Gender by Degree Area

Gender	PS N(%)	BS N(%)	SS N(%)	H N(%)	ED N(%)	ENGR N(%)	OTHER N(%)	TOTAL N(%)
Male	36(21)	27(15)	42(24)	22(13)	15(9)	23(13)	10(6)	175(100)
Female	4(7)	13(22)	15(26)	18(31)	7(12)	--	1(2)	58(100)
Total N	40(17)	40(17)	57(24)	40(17)	22(9)	23(10)	11(5)	233(100)

Note. Abbreviations for degree areas are: Physical science = PS, biological science = BS, social science = SS, humanities = H, education = ED, engineering = ENGR, and other = OTHER.

Pre-doctoral criteria

Table 3 presents the results of the regression analyses for the four continuous variables which pertained to the pre-doctoral years: satisfaction with PhD program (ranging from 1=very satisfied to 4=dissatisfied), number of years of professional work experience, number of publications, and number of papers presented at professional meetings. To statistically control for the significant relationship between gender and degree field noted above, an interaction term between gender and degree field was formed (denoted by M x G in Table 3) and was entered into the regression equation along with gender and degree field. Regression results revealed that gender was not a significant predictor for any of these four criteria, as the left-hand portion of Table 3 reports. However, with respect to differences among the degree fields, significant differences were found for half. Contrary to the hypothesis, majors did not differ on number of publications (M = 1.8, SD = 2.7); nor did they differ on number of papers presented at professional meetings (M = 1.7, SD = 4.8). However, major field was a significant predictor for the remaining two criteria (satisfaction with PhD program and number of years of professional work experience prior to reception of doctorate) and Table 4 presents the means for each degree group on both criteria. Social science doctorates were less satisfied with their PhD program while education and

Table 3

Multiple Regression Analyses of Pre-Doctoral Criteria Examining Gender and Major as Predictors

Criterion	Examining Gender as a Predictor			Examining Major as a Predictor		
	$R^2_{M \times G,M,G}$	$R^2_{M \times G,M}$	F(df's)	$R^2_{M \times G,M}$	$R^2_{M \times G}$	F(df's)
Satisfaction with PhD program	.13357	.13202	.39(1,219)	.13202	.03647	4.84(5,220)*
Number of years of professional work experience	.28402	.29333	.20(1,211)	.28333	.18062	6.07(5,212)*
Number of publications	.10518	.10491	.07(1,216)	.10491	.08244	1.09(5,217)
Number of papers read	.03634	.03572	.14(1,215)	.03572	.03390	.08(5,216)

Note. Degrees of freedom for denominator differed due to missing data. R^2 subscripts denote predictors: Major is designated as M, Gender as G, and the Major by Gender interaction as M x G.

*$P < .01$

Table 4

Mean (M) Level of Satisfaction with PhD Program and Mean Years of Pre-PhD Professional Work Experience, Separately by Degree Group

Degree Group	Program Satisfaction		Work Experience	
	M	SD	M	SD
Physical Science	1.8	.7	3.0	2.5
Biological Science	1.6	.6	3.4	3.6
Social Science	2.0	.8	4.1	3.5
Humanities	1.7	.8	5.1	3.7
Education	1.5	.5	10.6	7.3
Engineering	1.6	.6	6.0	4.3
Other	1.4	.5	11.1	10.6
Total	1.7	.7	5.1	5.1

"other" doctorates slightly more satisfied than average. And with respect to years of professional experience prior to receiving the doctorate, Table 4 reports that education and "other" doctorates had had over twice the number of years of pre-PhD professional work experience than the average (nearly 11 years of pre-PhD work experience for both education and other doctorates vs. an average of 5 years).

Table 5a presents results for the survey item asking "reason for initially obtaining a doctorate". However, before detailing the results of this survey item contained in Table 5a, it would be of benefit to outline in some detail the format employed in this report for the log-linear analysis of the three-way contingency table (that is, gender by major field by reason for obtaining doctorate), since as Wilson (Note 5) has noted, log-linear models have not often been employed in the analysis of categorical data in either psychological or educaticnal research. First,

the left-hand side of Table 5a presents a series of three hierarchical models, each of which has associated with it a likelihood ratio chi square (G^2). To control for the statistically significant relationship between gender and major field noted earlier, the interaction between these two variables was included in each model in the hierarchy (denoted by [GM] in Table 5a and in all subsequent log-linear analyses in this report). Next, the right-hand side of Table 5a sequentially tests for the statistical significance of gender and major where in log-linear models they are notated as interactions, that is, the interaction between gender and reason for entering doctoral program (denoted by [GR] in Table 5a) and the interaction between major field and reason for entering the doctoral program, respectively (denoted by [MR] in Table 5a). The test for each interaction term is merely the difference in G^2's between adjacent models in the hierarchy. This "difference G^2" is also distributed as a χ^2 with its df's being the difference between df's in adjacent models.

Now proceeding with the results contained in Table 5a, after controlling for the interaction between gender and major field, this table reports that the genders did not significantly differ in their reason for entering their doctoral program, contrary to the hypothesis. However, the degree fields did differ as shown by the statistical significance of the [MR] interaction ($G^2 = 68.99$, $df = 24$, $p < .01$) indicating that this interaction was important to the fit of the model. Therefore, the most parsimonious model fitting these data was the log-linear model denoted as [GM] [MR]. How might these log-linear results be best understood? In Bishop et al. (1978) a "collapsibility rule" for log-linear models is given. By this rule these authors indicate that one can collapse over either variable involved in a nonsignificant interaction (such as [GR] in the present instance) and not be mislead by the configuration of the original data presented as a three-way table. Therefore, Table 5b presents the data collapsed over gender--a two-way contingency table of major field by reason for entering the doctoral program results. Overall, humanities and social science doctorates were in the most agreement with over 60% of each degree group (specifically 78% and 61%, respectively) having entered their doctoral program in preparation for academic careers. Persons within

Table 5a

Reason for Entering Doctora' Program (R), Major (M), and Gender (G): Log-linear Analysis

Model	G^2(df)	Interaction	G^2(df) test of hypothesis that interaction = 0
[GM] [MR] [GR]	26.35(24)	--	--
[GM] [MR]	30.62(28)	GR	4.27(4)
[GM] [R]	99.61(52)**	MR	68.99(24)*

Note. Each successive interaction term in the hierarchy is tested by computing the difference in G^2's and df's from adjacent models.

*p < .01 **p < .001

Table 5b

Reason for Entering Doctoral Program: Number (N) and Percentage (%) Within Each Major Area

Reason	PS N(%)	BS N(%)	SS N(%)	H N(%)	ED N(%)	ENGR N(%)	OTHER N(%)	TOTAL N(%)
Academic career	12(30)	12(30)	35(61)	31(78)	9(41)	5(22)	5(45)	109(47)
Research career	14(35)	18(45)	6(11)	2(5)	1(5)	8(35)	--	49(21)
Career other than academic or research	1(3)	1(3)	6(11)	3(8)	4(18)	1(4)	--	16(7)
To extend education	13(33)	8(20)	9(16)	4(10)	4(18)	8(35)	4(36)	22(9)
Other	--	1(3)	1(2)	--	4(18)	1(4)	2(18)	9(4)
Total N	40(100)	40(100)	57(100)	40(100)	22(100)	23(100)	11(100)	233(100)

Note. Abbreviations for degree fields are: physical science = PS, biological science = BS, social science = SS, humanities = H, education = ED, engineering = ENGR, and other = OTHER.

the other degree fields were more diversified in their reasons and only for the biological science doctorates did "research careers" garner a substantial percentage (45%) as first-ranked alternative.

The next pre-doctoral survey item presented in Table 6a concerned primary source of support during graduate school (denoted as P in Table 6a) and was also analyzed using log-linear models. In Table 6a, as in Table 5a above, after controlling for the major field by gender interaction, the analyses report that the genders did not differ in their source of support but the major fields did differ significantly (G^2 = 94.43, df = 36, $p < .01$). The log-linear model which best fits the data was denoted by [GM] [MP]. Paralleling Table 5b, the data was collapsed over gender and Table 6b presents the two-way contingency table of major field by primary source of support. Indeed, the top-ranked source of support for the degree fields differed greatly with fellowships/traineeships being ranked first for biological science and social science doctorates (53% and 28%, respectively), teaching assistantships for humanities and other doctorates (35% and 36%, respectively), research assistantships for physical science and engineering doctorates (48% and 35%, respectively),and "student's own earnings" for education doctorates (32%).

Table 6a

Primary Source of Support (P), Major (M), and Gender (G):

Log-linear Analysis

Model	$G^2(df)$	Interaction	$G^2(df)$ test of hypothesis that interaction = 0
[GM] [MP] [GP]	19.52(36)	--	--
[GM] [MP]	30.98(42)	GP	11.46(6)
[GM] [P]	125.41(78)**	MP	94.43(36)*

Note. Each successive interaction term in the hierarchy is tested by computing the difference in G^2's and df's from adjacent models.

*$p < .01$ **$p < .001$

Table 6b

Primary Source of Support: Number (N) and Percentage (%) Within Each Major Area

Source of support	Physical Science N(%)	Biological Science N(%)	Social Science N(%)	Humanities N(%)	Education N(%)	Engineering N(%)	Other N(%)	Total N(%)
Fellowship or traineeship	5(13)	21(53)	16(28)	7(18)	3(14)	3(13)	1(9)	56(24)
Teaching assistantship	13(33)	6(15)	14(25)	14(35)	2(9)	1(4)	4(36)	54(23)
Research assistantship	19(48)	9(23)	6(11)	1(3)	--	8(35)	--	43(18)
GI bill	--	1(3)	1(2)	2(5)	3(14)	1(4)	1(9)	9(4)
Student's own earnings	--	1(3)	6(11)	7(18)	7(32)	5(22)	1(9)	27(12)
Spouse's earnings	3(8)	2(5)	9(16)	7(18)	3(14)	4(17)	1(9)	29(12)
Other	--	--	5(9)	2(5)	4(18)	1(4)	3(27)	15(6)
Total N	40(100)	40(100)	57(100)	40(100)	22(100)	23(100)	11(100)	233(100)

Responses to the open-ended survey item asking "If you were to enter graduate school today, in what type of graduate program would you enter?" were dichotomously coded as either "same program" or "different program." In order to determine if gender and/or major field were associated with this dichotomous response variable, a specific log-linear procedure, termed logit analysis, was employed. Table 7a presents the results of this logit analysis for the "likelihood of re-entry" survey item, where the models are expressed in the log-linear notation employed above in Tables 5a and 6a. After controlling for the interaction of gender and degree field, Table 7a reports that the genders did not differ significantly with respect to the likelihood of re-entering the same graduate program but degree fields did differ significantly ($G^2 = 4.37$, $\underline{df} = 1$, $\underline{p}<.05$). Collapsing over gender yields the two-way table of degree field by likelihood of re-entry presented in Table 7b. An inspection of Table 7b finds three trends. First, the most discrepant result concerned the biological science doctorates where 69% indicated they would not enter the same program today. Next, three degree groups (physical science, social science, and humanities) were nearly evenly divided about the prospects of re-entry. Lastly, over two-thirds of those in the remaining three doctoral fields (education, engineering, and others indicated they would definitely re-enter the same program today.

The final pre-doctoral questionnaire item was biographical in nature and concerned whether or not the doctorate had earned a master's degree. Being a dichotomously scored response variable, logit analysis was employed as the most appropriate technique. As with the other pre-doctoral variables, after controlling for the interaction between gender and major field, Table 8a reports that the genders did not differ significantly whereas the major fields did ($G^2 = 15.69$, $\underline{df} = 1$, $\underline{p} < .01$). Collapsing over gender Table 8b reports that the most glaring discrepancy concerned biological science doctorates where the majority did not have a master's degree. For the other six degree groups at least two-thirds had been awarded master's degrees.

Table 7a

Likelihood of Re-entering Graduate Program Today (E), Major (M), and Gender (G): Logit Analysis

Logit analysis in log-linear notation	G^2(df)	Interaction	G^2(df) test of hypothesis that interaction = 0
[GM] [ME] [GE]	9.16(8)	--	--
[GM] [ME]	11.07(9)	GE	1.91(1)
[GM] [E]	15.44(10)	ME	4.37(1)*

Note. Each successive interaction term in the hierarchy is tested by computing the difference in G^2's and df's from adjacent models.

*$p < .05$

Table 7b

Likelihood of Re-entering Graduate Program Today: Number (N) and Percentage (%) Within Each Major Area

Re-enter?	PS N(%)	BS N(%)	SS N(%)	H N(%)	ED N(%)	ENGR N(%)	OTHER N(%)	TOTAL N(%)
No	17(46)	22(69)	24(44)	19(51)	8(33)	7(37)	1(10)	98(46)
Yes	20(54)	10(31)	30(56)	18(49)	16(67)	12(63)	9(90)	115(54)
Total N	37(100)	32(100)	54(100)	37(100)	24(100)	19(100)	10(100)	213(100)

Note. Abbreviations for degree areas were: physical science = PS, biological science = BS, social science = SS, humanities = H, education = ED, engineering = ENGR, and other = OTHER.

Table 8a

Master's Degree (D), Major (M), and Gender (G): Logit Analysis

Logit analysis in log-linear notation	G^2(df)	Interaction	G^2(df) test of hypothesis that interaction = 0
[MG] [MD] [GD]	21.28(8)	--	--
[MG] [MD]	21.28(9)	GD	.00(1)
[MG] [D]	36.97(10)*	MD	15.69(1)*

Note. Each successive interaction term in the hierarchy is tested by computing the difference in G^2's and df's from adjacent models.

*$p < .01$

Table 8b

Master's Degree: Number (N) and Percentage (%) Within Each Major Group

Master's degree?	PS N(%)	BS N(%)	SS N(%)	H N(%)	ED N(%)	ENGR N(%)	OTHER N(%)	TOTAL N(%)
No	15(38)	24(60)	12(21)	2(5)	1(5)	1(4)	1(9)	56(24)
Yes	25(63)	16(40)	45(79)	38(95)	21(95)	22(96)	10(91)	177(76)
Total N	40(100)	40(100)	57(100)	40(100)	22(100)	23(100)	11(100)	233(100)

Note. Abbreviations for degree areas are: physical science = PS, biological science = BS, social science = SS, humanities = H, education = ED, engineering = ENGR, and other = OTHER.

Essentially two main points emerged from this set of analyses concerning the pre-doctoral criteria. First, after controlling for the statistically significant interaction between gender and degree field, gender itself was not a statistically significant predictor in any analyses. However, the major fields did differ significantly on reason for entering their doctoral program, level of satisfaction with their doctoral program, primary source of support for their doctoral education, likelihood of re-entering the same doctoral program today, number of years of work experience prior to obtaining their doctorate, and whether or not they had a master's degree. The picture on the "positive" side seemed clearer than that on the "negative" side. That is, education and other doctorates were more satisfied than average, had had more years of work experience prior to obtaining their doctorate than average, had over 90% with master's degrees, and had the highest proportion of degree holders likely to re-enter the same program today. On the "negative" side the results were not as clear-cut. For example, social science doctorates were the least satisfied degree group; however, the biological science doctorates were the least likely to re-enter the same degree program today.

Post-doctoral criteria

Table 9 presents the results of multiple regression analyses for four post-doctoral criteria: job satisfaction (coded as 1=very satisfied to 4=dissatisfied), number of publications authored since reception of doctorate, number of papers read at professional meetings since reception of doctorate, and number of professional organizations. After controlling for the interaction of gender and major field, Table 9 reports that gender was not a significant predictor for any of these four criteria and that major field was statistically significant for only one criterion--number of professional memberships. Overall, the mean level of job satisfaction was slightly higher than the value of "2=satisfied" (M = 1.8, SD = .9) and the mean number of papers read at professional meetings was 2.3 (SD = 3.0). Two hypotheses were contradicted by these analyses: first, the degree fields did not differ significantly in their publication rate (M = 3.1, SD = 3.5); and second, they did differ significantly on their degree of "professional identification" as measured by

Table 9

Multiple Regression Analyses of Post-Doctoral Criteria Examining Gender and Major as Predictors

Criterion	Examining Gender as a Predictor			Examining Major as a Predictor		
	R^2 M x G,M,G	R^2 M x G,M	F(df's)	R^2 M x G,M	R^2 M x G	F(df's)
Satisfaction with job	.07505	.07189	.71(1,208)	.07189	.06258	.42(5,209)
Number of publications	.12050	.12049	<.01(1,212)	.12049	.09987	1.00(5,213)
Number of papers read	.06166	.06019	.34(1,214)	.06019	.04063	.89(5,215)
Number of professional memberships	.15146	.14350	2.01(1,214)	.14350	.04133	5.13(5,215)*

Note. Degrees of freedom for denominator differed due to missing data. R^2 subscripts denote predictors: Major is designated as M, Gender as G, and the Major by Gender interaction as M x G.

*$p < .01$

Table 10

Mean (M) Number of Professional Memberships, Separately by Degree Group

Degree Group	M	SD
Physical Science	2.1	1.2
Biological Science	2.3	2.4
Social Science	2.2	1.5
Humanities	2.4	1.7
Education	3.9	3.4
Engineering	1.7	1.2
Other	3.5	2.3
Total	2.4	2.0

number of professional memberships. Table 10 presents the mean number of professional memberships for each degree field. Education and other doctorates had more memberships than average ($M = 3.9$ and $M = 3.5$, respectively, versus $M = 2.4$ for the total group), while engineering doctorates had less than average ($M = 1.7$).

There were three survey items which pertained to job held immediately after reception of the doctorate: "job availability status," type of position, and difficulties encountered in obtaining a doctoral-level job in his/her area. The first such survey item, "job availability status" had four broad categories: (that is, returned to job held prior to entering PhD program, had job before dissertation was completed, found job after PhD was awarded, and returned to university for another degree). The log-linear analysis for the three-way contingency table (gender by degree field by job status) is presented in Table 11. After controlling for the interaction between gender and degree field (again denoted as [GM] in Table 11), the hierarchical model comparisons revealed that the null hypotheses concerning gender and major could not be rejected, that is, neither the [GJ] nor [MJ] interaction was statistically significant. Therefore, the log-linear model which best fits these data

was denoted by [GM] [J]--the conditional independence of gender and job status given major or, alternatively, the conditional independence of major field and job status given gender. Overall, for the entire group 9% returned to the job held prior to entering the doctoral program (N = 21), 27% had a job prior to completing their dissertation (N = 27), the bulk (63%) obtained their job after the PhD was awarded (N = 145), and the remaining 1% returned to school to complete another degree program.

Table 12a presents the results to the log-linear analysis for the second survey item concerning initial job after doctorate, type of position held. Again after controlling for the interaction between gender and major field, Table 12a reports that the genders did not differ significantly in type of position while the major fields did (G^2 = 130.09, df = 48, p < .001). The most parsimonious model in the hierarchy describing the data was denoted by [GM] [MP]. Collapsing over gender, Table 12b presents the two-way contingency table of degree field by type of position. As was hypothesized, physical science and biological science doctorates had the highest percentage of post-doctoral fellowships (28% and 38%, respectively). College/university teaching was the top-ranked alternative for social science, humanities, and other doctorates (39%, 39%, and 74%, respectively), research for physical science and engineering doctorates (40% and 30%, respectively), post-doctoral fellowships for biological science doctorates (38%), and elementary school teaching or administration for education doctorates (32%).

The third survey item related to initial job placement asked "Describe any difficulties you may have had obtaining a doctoral-level position in your area." The first response given was content-analyzed and used in the analysis. The response categories are found in the left column of Table 13b. Table 13a presents the log-linear analysis for the three-way contingency table (difficulty by gender by degree field). As in the previous log-linear analyses included in this report, the interaction between gender and major field was controlled for and the importance of gender then was considered by testing the "gender by difficulty" interaction (denoted by [GD] in Table 13a). Gender was statistically significant (G^2 = 13.38, df = 6, p < .05) as "Hierarchy 1"

Table 11

Job Availability Status (J), Major (M), and Gender (G):

Log-linear Analysis

Model	G^2(df)	Interaction	G^2(df) test of hypothesis that interaction = 0
[GM] [MJ] [GJ]	11.74(18)	--	--
[GM] [MJ]	18.66(21)	GJ	6.92(3)
[GM] [J]	47.34(39)	MJ	28.68(18)

Note: Each successive interaction term in the hierarchy is tested by computing the difference in G^2's and df's from adjacent models.

Table 12a

First Post-Doctoral Position (P), Major (M), and Gender (G):

Log-linear Analysis

Model	G^2(df)	Interaction	G^2(df) test of hypothesis that interaction = 0
[GM] [MP] [GP]	26.18(48)	--	--
[GM] [MP]	28.38(56)	GP	2.2(8)
[GM] [P]	158.47(104)*	MP	130.09(48)*

Note. Each successive interaction term in the hierarchy is tested by computing the difference in G^2's and df's from adjacent models.

*$p < .001$

Table 12b

First Post-Doctoral Position: Number (N) and Percentage (%) Within Each Major Area

Position	Physical Science	Biological Science	Social Science	Humanities	Education	Engineering	Other	Total
	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)
College-University teaching	11(28)	8(21)	22(39)	22(39)	4(18)	2(9)	7(74)	81(35)
Community college teaching or administration	1(3)	--	2(4)	3(8)	4(18)	--	--	10(4)
Elementary school teaching or administration	--	--	2(4)	1(3)	7(32)	--	--	10(4)
Post-doctoral fellowship	11(28)	15(38)	3(5)	--	--	3(13)	--	32(14)
Research	16(40)	13(33)	11(20)	2(5)	1(5)	7(30)	--	50(22)
Clinician or social service administration	--	--	6(11)	1(3)	3(14)	--	--	10(4)
Other PhD-level job	--	--	6(11)	1(3)	3(14)	5(22)	3(27)	18(8)
Non-PhD-level job	--	3(8)	4(7)	4(10)	--	2(9)	--	13(6)
Military	1(3)	--	--	--	--	4(17)	1(9)	6(3)
Total	40(100)	39(100)	56(100)	39(100)	22(100)	23(100)	11(100)	230(100)

Note. Missing data: N = 3.

Table 13a

Difficulty in Obtaining PhD Level Job (D), Major (M), and Gender (G): Log-linear Analysis

Model	G^2(df)	Interaction	G^2(df) test of hypothesis that interaction = 0
Hierarchy 1: Initially Considering Gender by Difficulty Interaction			
[GM] [MD] [GD]	21.94(36)	--	--
[GM] [MD]	35.32(42)	GD	13.38(6)*
Hierarchy 2: Initially Considering Major by Difficulty Interaction			
[GM] [GD] [MD]	21.94(36)	--	--
[GM] [GD]	45.01(72)	MD	23.07(36)
[GM] [D]	58.99(78)	GD	13.98(6)*

Note. Each successive interaction term in a hierarchy is tested by computing the difference in G^2's and df's from adjacent models.

*$p < .05$

Table 13b

Difficulty in Obtaining PhD Level Position:

Number (N) and Percentage (%) for Each Gender

Difficulty	Males N(%)	Females N(%)	Total N(%)
No difficulty mentioned	110(63)	27(47)	137(59)
Few teaching/academic jobs	8(5)	6(10)	14(6)
Global complaint about "lack of PhD-level jobs"	4(2)	2(3)	6(3)
Complaint about "lack of permanent jobs", "funding cutbacks"	7(4)	2(3)	9(4)
Generalized complaint about "tight" job market	35(20)	14(24)	49(21)
Geographic limitations	5(3)	2(3)	7(3)
Other	6(3)	5(9)	11(5)
Total N	175(100)	58(100)	233(100)

on the top portion of Table 13a reports. On one hand the analysis could cease at this point and we could consider the model having all two-way interactions (denoted by [GM] [MD] [GD] in Table 13a) as the most parsimonious model. However, since there is no one "correct" hierarchy in log-linear analysis, a second hierarchy was constructed which initially considered the impact of major and subsequently considered the impact of gender. This alternative hierarchy was called "Hierarchy 2" in the bottom portion of Table 13a and reports that the major fields did not differ significantly. Therefore, the most parsimonious model resulting from Hierarchy 2 was denoted by [GM2 [GD]. Collapsing over majors, Table 13b presents the two-way contingency table of gender by difficulty. Overall, women were more likely to have indicated that they had had difficulty in obtaining a doctoral-level job in their area (53% of the women indicated having had difficulty vs. only 37% of the men). The three areas where women reported having had the most difficulty were complaints about the availability of academic teaching jobs, general complaints about the "tight" job market, and complaints encompassed by the "other" category which were too too specific to warrant their own category. Examples of comments included under "other" were" comments about the dissertation being too academic, lack of work experience in field, one woman commented that she was paid less than a man, and one man complained that all the available jobs went to women. Overall, therefore, while the genders did differ significantly on their difficulty in obtaining a doctoral-level job, very few comments were specifically related to their gender.

Doctorates were asked to indicate the primary source of assistance received from the University in their job search. Table 14 presents the log-linear analysis for this survey item. After controlling for the interaction of gender and major field, Table 14 reports that neither gender nor degree field was statistically significant. And the model which best describes the data was denoted as [GM] [A] in this hierarchy. For the total group the responses to this survey item were: 31% indicated doctoral committee chair was most helpful ($\underline{N}$ = 68), 10% indicated that a doctoral committee member other than the chair was most helpful ($\underline{N}$ = 22), 8% reported that another faculty member was most helpful ($\underline{N}$ = 17), 6% reported that the UW Placement Office was most helpful ($\underline{N}$ = 14), 10% indicated that major assistance came from off-campus ($\underline{N}$ = 23), 14% wrote that the

Table 14

Primary UW Assistance in Job Search (A), Major (M), and Gender (G):

Log-linear Analysis

Model	G^2(df)	Interaction	G^2(df) test of hypothesis that interaction = 0
[GM] [MA] [GA]	19.66(36)	--	--
[GM] [MA]	20.01(42)	GA	0.35(6)
[GM] [A]	50.99(78)	MA	30.98(36)

Note. Each successive interaction term in the hierarchy is tested by computing the difference in G^2's and df's from adjacent models.

Table 15

Anticipated Job Change (A), Major (M), and Gender (G):

Log-linear Analysis

Model	G^2(df)	Interaction	G^2(df) test of hypothesis that interaction = 0
[GM] [MA] [GA]	5.76(12)	--	--
[GM] [MA]	5.99(14)	GA	0.23(2)
[GM] [A]	13.98(26)	MA	7.99(12)

Note. Each successive interaction term in the hierarchy is tested by computing the difference in G^2's and df's from adjacent models.

"University was of no help" (N = 30), and the remaining 21% reported that a source other than one of the above was most helpful (e.g., a friend).

The final post-doctoral survey item asked if respondents anticipated a job change within the next two years and Table 15 presents the results for the log-linear analysis. After controlling for the interaction of major and degree field, Table 15 reports that neither gender nor major field was statistically significant; [GM] [A] was the model which best described this data. Overall, the majority anticipated making a job change (58%), 36% did not expect to make such a change, and a small percentage, 5%, were uncertain.

To re-cap these results we find fewer significant differences noted for the post-doctoral criteria than for the pre-doctoral criteria. After controlling for the interaction between gender and degree field, two significant differences were reported for major field collapsed over gender and one for gender collapsed over major field. Specifically, the degree fields differed significantly in number of professional memberships with education and "other" doctorates having had a greater mean number of memberships. With respect to job held immediately after reception of the doctorate, the genders differed in the difficulty had in obtaining a doctoral-level position in their area with women reporting more difficulty than men across all degree fields. However, while the degree fields differed among themselves with respect to the type of position held, the genders within an area did not differ significantly. There were no differences between the genders nor among the degree fields for the majority of the post-doctoral items surveyed: degree of job satisfaction, job availability status at the time of graduation, type of support received from UW in job search, and anticipation of job change in the next two years.

Discussion

As was hypothesized, male and female doctorates differed significantly in degree fields. Females were more likely to have earned doctorates in humanities and social sciences, while the largest proportion of males had been awarded degrees in the social sciences and physical

sciences. However, after statistically controlling for this interaction between gender and degree field, the log-linear and regression analyses revealed that the largest number of significant differences were among the degree groups regardless of gender. With one exception, the genders in a particular area were more alike than dissimilar in their early professional experiences. Enumerating these differences among the degree groups, survey results reported the following:

1. The degree fields differed on all three survey items which tapped "research orientation." That is, significant differences were noted among the groups on their major reason for entering graduate school, primary source of support during graduate school, and type of position held immediately after receiving their doctorate with physical science, biological science, and engineering doctorates more likely to have had research-related responses to each of these survey items than the remaining four doctoral groups.
2. The degree groups also differed significantly on both of the pre-doctoral "satisfaction" criteria, that is, likelihood of re-entering the same program today and overall satisfaction with their doctoral program. Education and "other" doctorates were more likely to re-enter the same program and indicated a higher mean level of satisfaction than average. On the other side of the coin, biological science doctorates were the least likely to re-enter the same program today while social science doctorates indicated the lowest mean level of satisfaction. However, the degree groups did not differ significantly on the third "satisfaction" criteria which assessed overall job satisfaction with all degree groups having indicated above average level of job satisfaction at the time they were surveyed.
3. In addition, the doctoral fields differed significantly on the amount of professional work experience had prior to receiving their degree with education and "other" doctorates having been employed for twice as long as the average doctorate.
4. And differences were found on the degree of "professional identification" as assessed by number of memberships had at the time the survey was taken. Again, education and "other"

doctorates stand out with doctorates in these two groups having belonged to more professional organizations than average.

5. Lastly, the major groupings differed on the item which asked whether or not they had a master's degree. Those in the biological sciences were least likely to have had a master's.

And, contrary to the hypothesis, the degree groups did not differ significantly on their publication rate either prior to obtaining their doctorate or during the three-year period after receiving their doctorate. Nor did they differ on the two related criteria--number of papers presented at professional meetings assessed before and after the doctorate.

As noted above, there was only one statistically significant gender-related difference which cut across degree groups and it concerned one of the three items related to job held immediately after reception of the doctorate. That is, women indicated having had more difficulty in obtaining a doctoral-level position in their area. However, while the degree fields differed in the type of job held, as was documented above, the genders within a field did not differ significantly. Furthermore, for the third criterion in this cluster, job availability status at time of degree, neither gender nor major field was significant. It would appear, therefore, that a question asking "Does there exist male-female differences in first job placement for doctorates?" cannot be simply answered based upon the results from this survey. One could state the following, however, based upon the results from this survey of UW doctorates: It appears that women doctorates regardless of degree field experienced more difficulty in finding a doctoral-level position in their area <u>but</u> men and women within a degree field did not differ significantly in the specific type of job which they eventually had.

It is anticipated that the current paper will provide two services. First is its substantive contribution. These analyses not only provide the University community with a portrait of the early career experiences of one cohort of UW doctorates who had received their degrees in the

mid-1970's, but also can serve baseline data for future surveys of our doctoral recipients. The second contribution is statistical and concerns the application of log-linear analyses to an issue in higher education. It is hoped that these analyses might serve as an illustration of this technique to other researchers. Categorical variables have been traditionally analyzed as two-way tables using the χ^2 statistic. Frequently researchers attempt to make inferences from a series of chi square analyses when it would be more appropriate to apply log-linear techniques to the data; for examples of misapplications and faulty generalization see either Fienberg (1977) or Wilson (Note 5). Essentially, log-linear techniques should be viewed as merely extensions of the χ^2 techniques taught in basic statistics courses. The ready availability of canned statistical programs, such as ECTA (Goodman, 1973), makes their application even more inviting.

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Appendix A

Degree Areas and Related Majors

Physical Sciences

- Astronomy
- Atmospheric Sciences
- Chemistry
- Forest Resources
- Geological Sciences
- Geophysics
- Mathematics
- Oceanography
- Physics

Biological Sciences

- Anatomy
- Biochemistry
- Biological Structures
- Biomathematics
- Biostatistics
- Botany
- Fisheries
- Genetics
- Microbiology & Immunology
- Pathology
- Pharmaceutical Sciences
- Pharmacology
- Physiology & Biophysics
- Physiology Psychology
- Special Individual Ph.D. (ex. Fisheries & Genetics)
- Zoology

Social Sciences

- Anthropology
- Economics
- Geography
- History
- Political Science
- Psychology
- Sociology

Humanities

- Asian Languages & Literature
- Classics
- Communications
- Comparative Literature
- Drama Arts
- English
- Germanics
- Linguistics
- Music
- Philosophy
- Romance Languages & Literature
- Scandinavian Languages & Literature
- Slavic Languages & Literature
- Speech
- Theater Arts

Education

- Includes all majors in the Coll. of Ed.

Engineering

- Aeronautics & Astronautics
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Mechanical Engineering
- Nuclear Engineering
- Special Individual Ph.D. (ex., Clinical Engineering)

Other

- Business Administration
- Urban Planning
- Special Individual Ph.D.s not readily categorized into one of the other areas